We claim:

1. A device for applying a variable differential group delay to a signal at an input of the device, and for providing the modified signal at an output of the device, the device comprising:

first, second and third birefringent elements arranged in order between the input and output of the device and having first, second and third differential group delays (DGDs) in the ratio 1:2:1, and having principal axes;

means for controlling, in each birefringent element, the orientation of the PSPs of the signal in the element relatively to the principal axes of the element, the control being such that a change in orientation between the first and second elements is equal and opposite to a change in orientation between the second and third elements.

2. A polarization mode dispersion (PMD) compensator for receiving an optical input data signal which has been subjected to PMD and outputting a compensated signal, the compensator comprising a device for applying a variable differential group delay according to claim 1.

3. A device as claimed in claim 1, wherein the control means comprises:

means for varying the orientation of the principal axes of the second birefringent element relative to the first birefringent element and for varying the orientation of the principal axes of the third birefringent element relative to the second birefringent element,

wherein the varying means is controlled such that the angle of the principal axes of the second birefringent element relative to the first birefringent element is equal and opposite to the angle of the principal axes of the third birefringent element relative to the second birefringent element.

4. A device as claimed in claim 3, wherein the varying means comprises means for rotating the first, second and third birefringent elements.

5. A device as claimed in claim 4, wherein the rotating means is adapted to rotate the first birefringent element by a selected angle in a first sense, to rotate the second birefringent element by the selected angle in a second, opposite sense, and to rotate the third birefringent element by the selected angle in the first sense.

6. A device as claimed in claim 5, wherein the selected angle can vary between 0 and $\pi/4$ radians.

7. A device as claimed in claim 1, wherein the control means comprises:

first means for varying the orientation of the PSPs of a signal between the first and second birefringent elements; and

second means for varying the orientation of the PSPs of a signal between the second and third birefringent elements,

wherein the first and second means are controlled such that they vary the orientation by equal and opposite amounts.

8. A device as claimed in claim 7, wherein each varying means comprises a polarization rotator.

9. A device as claimed in claim 8, further comprising a polarization controller at the input to the device for selecting the orientation of the PSPs of the signal in the first birefringent element relatively to the principal axes of the first birefringent element.

10. A device for applying a variable differential group delay to a signal at an input of the device, and for providing the modified signal at an output of the device, the device comprising first and second compensator units, wherein the first compensator unit comprises:

first, second and third birefringent elements arranged in order between the input and output of the compensator and having first, second and third differential group delays (DGDs) in the ratio 1:2:1, and having principal axes;

first control means for controlling, in each birefringent element, the orientation of the PSPs of the signal in the element relatively to the principal axes of the element, the control being such that the change in orientation between the first and second elements is equal and opposite to the change in orientation between the second and third elements, and wherein the second compensator unit comprises:

first and second birefringent elements arranged between the input and output of the second compensator unit and having equal DGDs, and having principle axes; and

second control means for controlling, in each birefringent element, the orientation of the PSPs of the

signal in the element relatively to the principal axes of the element.

11. A polarization mode dispersion (PMD) compensator comprising a device for applying a variable differential group delay according to claim 10.

12. A device as claimed in claim 10, wherein the DGDs of the elements of the second compensator unit are equal to the DGD of the second birefringent element of the first compensator unit.

13. A device as claimed in claim 10, wherein the first control means comprises:

first means for varying the orientation of the PSPs of a signal between the first and second birefringent elements; and

second means for varying the orientation of the PSPs of a signal between the second and third birefringent elements,

wherein the first and second means are controlled such that they vary the orientation by equal and opposite amounts.

14. A device as claimed in claim 13, wherein each varying means comprises a polarization rotator.

15. A device as claimed in claim 10, wherein the second control means comprises:

first means for varying the orientation of the PSPs of a signal at the input of the first birefringent element;

second means for varying the orientation of the PSPs of a signal between the first and second birefringent elements; and

third means for varying the orientation of the PSPs of a signal at the output the second birefringent element.

16. A device as claimed in claim 15, wherein the first varying means provides a rotation of a selected angle in a first sense, the second varying means provides a rotation of double the selected angle in a second, opposite sense, and the third varying means provides a rotation of the selected angle in the first sense.

17. A device as claimed in claim 16 wherein the change in orientation θ in the first compensator unit and the selected angle $\varphi/2$ in the second compensator unit are selected such that $\varphi - \theta = \pi$ radians.

18. A device as claimed in claim 15, wherein each means for varying comprises a polarization rotator.

19. A PMD compensator as claimed in claim 11, further comprising a first order PMD compensator.

20. A compensator as claimed in claim 19, wherein the first order PMD compensator comprises:

first, second and third birefringent elements arranged in order between the input and output of the compensator and having first, second and third differential group delays (DGDs) in the ratio 1:2:1, and having principal axes;

means for controlling, in each birefringent element, the orientation of the PSPs of the signal in the element

relatively to the principal axes of the element, the control being such that a change in orientation between the first and second elements is equal and opposite to a change in orientation between the second and third elements.

21. A device for applying a variable differential group delay to a signal at an input of the device, and for providing the modified signal at an output of the device, the device comprising:

at least four birefringent elements arranged between the input and output of the device, and having principal axes, each birefringent element being associated with a control device for controlling the orientation of the PSPs of the signal in the element relatively to the principal axes of the element; and

a controller for controlling the control devices such that, for all settings of the device, at most two of the birefringent elements have orientations other than 0 or 90 degrees.

22. A polarization mode dispersion (PMD) compensator for receiving an optical input data signal which has been subjected to PMD and outputting a compensated signal, the arrangement comprising a device according to claim 21.

23. A device as claimed in claim 21, wherein there are n birefringent elements, each having the same DGD.

24. A device as claimed in claim 23, wherein the device provides a net DGD between 0 and n times the DGD of each element.

25. A device as claimed in claim 21 comprising 6 birefringent elements, the control device of the first birefringent element comprising a polarization controller, and the control device of the second to sixth birefringent elements comprising a polarization rotator.

26. A method of providing mode dispersion (PMD) compensation comprising:

passing an input signal through first, second and third birefringent elements arranged in order between the input and output of the compensator and having first, second and third differential group delays (DGDs) in the ratio 1:2:1;

controlling, in each birefringent element, the orientation of the PSPs of the signal in the element relatively to the principal axes of the element, the control being such that a change in orientation between the first and second elements is equal and opposite to a change in orientation between the second and third elements.

27. A method as claimed in claim 26, wherein controlling the orientation comprises rotating the second birefringent element relative to the first birefringent element and rotating the third birefringent element relative to the second birefringent element, wherein the rotation is controlled such that the angle of the principal axes of the second birefringent element relative to the first birefringent element is equal and opposite to the angle of the principal axes of the third birefringent element relative to the second birefringent element.

28. A method as claimed in claim 27, wherein the first birefringent element is rotated by a selected angle in a first sense, the second birefringent element is rotated by the selected angle in a second, opposite sense, the third birefringent element is rotated by the selected angle in the first sense.

29. A method as claimed in claim 26, wherein controlling the orientation comprises using polarization rotators to vary the orientation of the PSPs of a signal between the first and second birefringent elements and between the second and third birefringent elements by equal and opposite amounts.

30. A method of providing polarization mode dispersion (PMD) compensation comprising:

passing an input signal through at least four birefringent elements, each birefringent element being associated with a control device for controlling the orientation of the PSPs of the signal in the element relatively to the principal axes of the element; and

controlling the control devices such that, for all PMD compensation settings of the compensator, at most two of the birefringent elements have orientations other than 0 or 90 degrees.

31. A method as claimed in claim 30, wherein each birefringent element has the same DGD.

32. A method as claimed in claim 31, wherein a first set of orientations provides zero DGD and a second set of orientations provides maximum DGD, wherein the orientations for all birefringent elements are 0 or 90 degrees for the first and second sets.

33. A method as claimed in claim 32, wherein the control devices for a first pair of birefringent elements are varied oppositely to increase the DGD from zero to a first intermediate value, and the control devices for a second pair of birefringent elements are varied oppositely to increase the DGD from the first intermediate value to a second intermediate value.

34. A method as claimed in claim 32, wherein the input signal is passed through 6 birefringent elements, the control device of the first birefringent element comprising a polarization controller, and the control device of the second to sixth birefringent elements comprising a polarization rotator.